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PROVISIONAL APPLICATION FOR PATENT COVER SHEET

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(c).

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INVENTOR(S)

Given Name (first and middle [if any])	Family Name or Surname	Residence (City and either State or Foreign Country)
Susan L.	GILES	San Mateo, California

Additional inventors are being named on the ________ *separately numbered sheets attached hereto*

TITLE OF THE INVENTION (500 characters max)

COMPUTER MOUSE

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[Page 1 of 2]

Respectfully submitted,

SIGNATURE Paul Tomita

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USE ONLY FOR FILING A PROVISIONAL APPLICATION FOR PATENT

UNITED STATES PROVISIONAL PATENT APPLICATION

FOR

COMPUTER MOUSE

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COMPUTER MOUSE

Field of the Invention

This invention is related to an electro-mechanical mouse input device for a computer.

Background of the Invention

Mouse input devices for computers are well known in the art. The movement of the mouse in an X-Y plane typically actuates a mechanical, optical or electrical device within the mouse that produces X and Y position signals that are conveyed to the computer. The computer typically uses the mouse X and Y position signals to manipulate the display of the computer screen, allowing a user to control a program. A computer mouse also typically has one or more buttons which allow the user to further control a computer program. The mouse and mouse button allow the user to move a cursor or other pointing device to a specific area of the computer screen and depress the one or more buttons to activate specific computer program functions. In general, the mouse buttons are actuated by pressing the button downward.

With the proliferation of home and school computers, people are becoming computer literate at earlier ages. Software companies are developing educational programs for use by young children. These programs require children to operate a computer mouse.

One of the problems associated with a computer mouse is that children have great difficulty with the combined action of positioning the mouse in the required X-Y

coordinate while at the same time operating the one or more buttons. A computer mouse is typically designed for adult hands with buttons designed for adult fingers. When the adult computer mouse is used by small children, the movement and button activation can be very difficult.

The prior art has attempted to make the computer mouse more user-friendly; however, these designs are generally designed to reduce hand injuries including carpal tunnel syndrome. Examples of the ergonomic computer mouse include U.S. Patent Nos. 5,726,683 and 5,576,733 which both provide mouse bodies shaped for a more natural user hand position. Although these inventions address the problem of repetitive stress for adult hands, they do not aid children with the use of a computer mouse. U.S. Patent No. 6,323,843 is a prior art computer mouse designed by the present applicant, Susan Giles, which is specifically sized for children's hands to simplify the coordination requirements of positioning the computer mouse and activating the buttons.

Another problem with the existing computer mouse is that it typically has two buttons each having specific features. It can be very difficult for children to distinguish actuation of the right button from the left button. These buttons are configured so that they are only actuated when the buttons are rotated forward even if the surface of the button extends over the sides of the mouse body. This forward rotation button actuation can also be difficult for children to accurately control.

In view of the foregoing, what is needed is a computer mouse that allows small hands to easily actuate the buttons and can also be easily used by larger adult hands.

SUMMARY OF THE INVENTION

The present invention is a child's computer mouse for controlling a cursor and inputting information into a computer. The inventive computer mouse includes an internal position detection mechanism and two buttons that electrically actuate features of a computer program. The mouse body is substantially hemispherical in shape, and the two buttons are mounted adjacent to each other on a front portion of the mouse. The buttons are curved downward from the top to the front and sides of the mouse. The buttons are attached to hinges that are close to the top and center of the buttons that allow the buttons to rotate forward or sideways. The hinges allow the buttons to be actuated by applying a downward force to the buttons or by a squeezing any side surface of the buttons. The squeezing action can be compression of the front and back of the mouse, the sides of the mouse or any combination such as a diagonal motion between the side and back of the mouse.

The inventive mouse has two buttons. Typically, the actuation of each button results in different commands to the computer depending upon the software program with which the mouse is being used. In general, the left button is used for basic operations and is required for proper operation of the program, while the right button is used for special commands and is generally not required to operate the program. The function of the buttons is controlled by software "drivers" which define the interaction of all computer hardware with the computer software.

Different software drivers can be used to alter its operation of the inventive mouse. A "two-button" driver is used so that the left and right mouse buttons operate independently. Alternatively a "single-button" driver can cause the mouse to operate as a

mechanisms described above. It is intended that all such modifications, substitutions and additions fall within the scope of the present invention that is best defined by the claims below.

single-button mouse. When a single-button mouse driver is used, the actuation of either the left or right mouse buttons, independently or together, is interpreted by the computer as the actuation of only the left button. The single-button driver is particularly useful when the mouse is used by children or adults who are just learning how to use a computer because the actuation of the button is simplified.

Because the inventive mouse is substantially a hemispheric shape and has buttons that are actuated by multiple types of motion, the child can more easily control the inventive mouse. The small hemispheric shape of the inventive mouse allows the child to manipulate the mouse position by grasping any surface, and the spherical shape of the buttons allows the buttons to be actuated by squeezing the mouse in any direction.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a cutaway side view of an embodiment of the inventive mouse;

Figure 2 is a top view of an embodiment of the inventive mouse;

Figure 3 is a cutaway top view of an embodiment of the inventive mouse;

Figure 4 is a cutaway side view of an embodiment of the inventive mouse;

Figure 5 is a top view of horizontal forces that can be applied to the inventive mouse;

Figure 6 is a front view of the mouse and horizontal squeezing forces applied to actuate the buttons;

Figure 7 is a cutaway side view of an embodiment of the inventive mouse;

Figure 8 is a top view of a hand; and

Figure 9 is a top view of a single-button embodiment of the inventive mouse.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The following is a detailed description of the preferred embodiments of the present invention. However, the present invention is in no way intended to be limited to the embodiments discussed below or shown in the drawings. Rather, the description and the drawings are merely illustrative of the presently preferred embodiments of the invention.

The mouse produces X and Y position signals that are related to the movement of the mouse as well as signals indicating that either of two switches are activated. A cut-away left side view of the exemplary inventive mouse 101 is shown in Figure 1. The mouse 101 comprises the following: body 103, left button 105, base 107, left switch 109, roller ball 111 and circuit board 131. The left button 105 has a left hinge 117 that is attached to the body 103 and allows the left button 105 to rotate down or sideways. An internal rib 153 is mounted under the left button 105 and contacts the left internal switch 109. The left internal switch 109 is mounted on the internal circuit board 131 that is attached to the base 107. The roller ball 111, the left switch 109 and the circuit board 131 are accessible by removing the base 107 from the body 103. The inventive mouse has both a left and a right button that individually rotate about left and right hinges to actuate left and right switches.

When the mouse 101 is moved across a surface, the roller ball 111 rotates and position transducers (not shown) mounted proximate to the roller ball 111 convert the X and Y movements of the mouse 101 into electrical signals that are electrically transmitted to a computer through a flexible wire connection. These transducers are conventional and well known to those skilled in the art. In the preferred embodiment, the roller ball

111 is in contact with an X-axis rotational transducer and a Y-axis rotational transducer that are substantially perpendicular to each other. When the roller ball 111 rotates in the X direction, the X-axis rotational transducer transmits an X-axis positional signal to the computer and similarly when the roller ball 111 rotates in the Y direction, the Y-axis rotational transducer transmits a Y-axis positional signal. In alternate embodiments, the roller ball mechanism may be replaced by optical transducers or any similar mechanism that sense the movement of the mouse and convert the movement into electrical signals representing the X and Y position.

An advantage of the inventive mouse is that it has a hemispherical shape and buttons that curve around the periphery of the mouse and that are actuated by multiple motions. The shape of the mouse allows small hands to cup the mouse and coordinate the mouse movement more easily than a larger conventional mouse. The curvature of the button surfaces allows actuation with a peripheral squeezing motion between any of the user's fingers and/or palm.

The buttons of the inventive mouse are large and curved downward along the front and sides of the mouse. The buttons 105 are attached to the mouse body 103 at a hinge 117 located just below the intersection of the body 103 and button 105 at the top center of the mouse 101. The curved shape of the button 105 and the position of the hinge 117 allow the switch 109 to be activated with either a direct downward, a horizontal compressive or a rotational force applied by the user to button 105. The horizontal force can be applied to any portion of the periphery of the button including the front or sides of the button. As discussed, small hands of children can more easily

activate the switch by squeezing the button 105 of the mouse 101, and the button 105 can also be actuated with a downward force like other computer mice designed for adults.

The curved shape of the button 105 and the position of the hinge 115 allow the switches 109 to be activated as described above. The button 105 is mounted on the front of the mouse 101 and is curved downward from the top of mouse 101 about the front and sides. The front portion 104 of the button 105 and the back portion 106 of the body 103 are substantially perpendicular to the base 107. With the mouse 101 placed between the hand's palm and fingers, a compressive force can be applied to actuate the buttons 105 and switches 109 (not shown). The sides of the mouse 101 are also curved and intersect the base 107 at substantially perpendicular angles, and any peripheral side of the mouse button can be squeezed to actuate the buttons 105. These vertical side button surfaces allow a hand's thumb and fingers to compress the sides of the mouse 101 to actuate the buttons 105.

Larger hands can also easily use the mouse 101. The sides of the mouse body 103 can be grasped between the thumb and the third finger or the little finger, and by resting the palm on a planar surface, the position of the mouse 101 can be precisely controlled. By holding the mouse 101 as described, the index and middle fingers can rest on the tops of the left button 105 and the right button 105 (not shown). The index and middle fingers can easily actuate the left button 105 and right button 105 by applying downward forces to the horizontal top sections of the buttons 105. By depressing the top surfaces of the buttons 105, the operation of the mouse 101 is similar to that of a conventional mouse. Because the mouse 101 can be easily used by both adults with normal-sized hands and

children with small hands, the mouse 101 does not have to be changed depending upon the user of the computer.

Figure 2 illustrates a top view of an embodiment of the inventive two-button mouse 201. A right hinge 127 is mounted close to the intersection of the right button 105 and the mouse body 103. The left hinge 117 is similarly mounted close to the intersection of the left button 105 and the mouse body 103. The right button 125 and right hinge 127 are functionally the same as the left button 105 and left hinge 117 but operate independently.

Figure 3 illustrates a cutaway top view of an embodiment of the inventive mouse 201. Both the left switch 109 and the right switch 129 may be mounted on a common circuit board 131. The right switch 129 is functionally identical to the left switch 109 but produces independent signals that are distinct from each other. The switches 109 and 129 used in the mouse 201 are well known to those skilled in the art.

As discussed, when the left button 105 is actuated, the left switch 109 transmits an electrical signal to a computer through a flexible wire connection, and when the right button 125 (shown in Figure 2) is actuated, the right switch 129 transmits an electrical signal. When no force is applied to the button 105 (shown in Figure 2), the internal switches 109 reset, and another signal is electrically transmitted to the computer. In alternative embodiments, the flexible wire transmission connection between the mouse and computer may be replaced by a light wave transmitter/receiver, radio frequency transmitter/receiver or any similar mechanism that are well known to those of ordinary skill in the electronics art.

Figure 4 illustrates a cross-sectional left side view of the inventive mouse 103 and the forces that may be applied to the mouse 103 to actuate the buttons 105. For simplicity, the left button 105, left hinge 113 and left switch 109 will simply be referred to as button 105, hinge 113 and switch 109. In order for the button 105 to rotate about the hinge 113 when the mouse 103 is squeezed, the hinge 113 must be positioned higher within the mouse body 103 than the front portion 104 of the button 105. When a horizontal force F_{1A} is applied to the front portion 104 of the button 105, an equal and opposite horizontal force F_{1B} exists at hinge 113. Because the forces F_{1A} and F_{1B} are not on the same vertical plane, a torque is generated that rotates the button 105. The torque produced by squeezing the button 105 is equal to the compressive force multiplied by the vertical distance between the hinge and the horizontal force F_{1A}. In the preferred embodiment, the hinge 113 is mounted close to the top of the mouse 103, maximizing the front portion 104 of button 105 upon which a compressive force will generate a clockwise torque about hinge 113.

As shown in Figure 4, for a downward force F_{2A} to rotate the button 105 clockwise, the hinge 113 must be mounted behind the button 105. Again, when a downward force F_{2A} is applied to the top portion 108 of the button 105, an equal and opposite force F_{2B} will exist at the hinge 113. Because the forces F_{2A} and F_{2B} are offset, a torque is generated equal to the force F_{2A} multiplied by the horizontal offset between the hinge 113 and the downward force F_{2A}. Note that any force substantially normal to the surface of the button 105 will produce a similar torque about the hinge 113.

The relative positions of the hinge 113 about which the button 105 rotates and the junction of the internal switch 109 and the button 105 must be configured in such a way

that either a downward force or a compressive force applied to the button 105 activates the internal switch 109. The curved surface of the button 105 allows a force to be exerted upon it at a range of angles. Thus, a downward force at the upper horizontal portion of the button 105, a diagonal force applied to the sloped section of the button 105 or a horizontal force applied to the front of the button 105 will actuate the internal switch 109.

In addition to actuation via direct rotational forces, a horizontal compressive force applied to a side vertical portions of the button 105 will also actuate the internal switch 109. Because the hinge 113 is more centrally located than the switch 109, any horizontal force exerted upon a lower surface of the button 105 will cause the button 105 to rotate and the hinge 113 to bend in torsion. The rotation of the button 105 will then actuate the internal switch 109.

In the preferred embodiment, the hinge 113 and the internal rib 115 are integral parts of the left and right buttons 105 and may be made out of a single piece of molded plastic. The hinge 113 is a tapered section of planar piece of the plastic 361 which can elastically deflect, allowing the button 105 to rotate when a force is applied to the button 105. As discussed, the internal rib 115 under the button 105 rests on the switch 109. The button 105 rotates about the hinge 113 by either the application of a downward, a compressive or a torsional force, the internal rib 115 depresses the switch 109, and the hinge 113 elastically deflects. When the force is released from the button 105, the hinge 113 assumes its normal straight position and the switch 109 is de-actuated. Because plastic elastically deflects, the hinge 113 acts as a reset spring that tends to return to its normal straight position when no forces are acting on it. When the button 105 is released,

the internal spring (not shown) of the switch 109 also pushes the internal rib 115 up and rotates the button 105 about the hinge 113 into a normal position.

As discussed above, the button 105 can be actuated by squeezing the side surfaces. Although this motion results in a torsional deflection of the hinge 113 rather than pure bending, the resulting actuation of the internal switch is the same. With reference to Figure 5, when the sides of the buttons 105, 125 are compressed, the hinges 117, 127 will bend in a twisting torsion motion rather than a pure bending motion as described above. In order to actuate the buttons 105, 125 by squeezing the side surfaces, an equal and opposite force is applied to the opposite side of the mouse 103. For example, a diagonal compressive force 195 can be applied to actuate the right button 125. An opposite diagonal compressive force 197 can be applied to actuate the left button 105. Both the left button 105 and the right button 125 can be actuated by compressing the sides of both buttons 199.

The simultaneous horizontal squeezing of the two mouse buttons 105, 125 is also illustrated in Figure 6. When the user's hand is placed on the mouse, the thumb is naturally positioned over one of the buttons, and one or more of the opposing finger are positioned over the opposite button. The grasping or squeezing hand action is a simple motion that results in the actuation of the buttons 105, 125. When a horizontal force 199 is applied to squeeze both the buttons 105, 125, the action will result in the actuation of both internal switches. When used with the single button driver, the actuation of both the buttons 105, 125 will result in the transmission of a left button "click" to the computer program.

The mouse "driver" is the interface between the mouse hardware and the computer program. Different drivers are used depending upon the type of mouse being used, e.g., optical mouse, ball mouse, two-button mouse, single-button mouse, and roller wheel. Further different drivers can be used to alter the operation of the computer mouse. When the inventive computer mouse is used with a normal "two-button mouse driver," the mouse performs different functions depending upon the button that is depressed, i.e., the left button will result in a first program function and the right button will result in a second program function. If both buttons are pressed simultaneously, the driver will actuate the button that is depressed first.

In an alternative configuration, a "single-button mouse driver" can be used with the inventive two-button mouse. With the single-button driver, the left button functions will be actuated when either the left button or the right button is depressed or if both buttons are pressed simultaneously. The driver is particularly useful when the computer mouse is being used by a child or a beginning computer user who may grasp the mouse buttons with the thumb and fingers. When users want to click, the user can simply press either or both buttons. Because the buttons extend to the edges of the computer mouse, the user can squeeze the sides of the left and right buttons simultaneously between the thumb and fore fingers. The single-button driver can be used until the user becomes coordinated enough to differentiate left and right button clicks at which time the operation of the inventive mouse can be updated by installing the two-button driver.

Figure 7 illustrates another cross-sectional view of the right side of the inventive mouse 401 in another embodiment. Again for simplicity, the left button 405, left hinge 413 and left switch 409 will simply be referred to as button 405, hinge 413 and switch

409. To simplify assembly of the mouse 401, the button 405 may snap into the final assembled engagement with the body 403. As discussed, the hinge 413 may be an integral part of the button 405. In the preferred embodiment, a tab 441 having a hook 445 is attached to the distal end of the hinge 413 that is inserted into the mouse body 403 during assembly. The mouse body 403 has internal ribs 451 and a cross bar 453 that engage the tab 441. The hook 445 engages one of the internal ribs 451 and prevents the button 405 from being removed from the mouse body 403 after the mouse 401 is assembled. The button 405 is attached to the mouse body 403 by inserting the tab 441 horizontally into the mouse body 403. As tab 441 is inserted over the cross bar 453, the hook 445 contacts internal ribs 451 and is deflected downward. When the button 405 is fully inserted, and the hook 445 passes the internal ribs 451, the hook 445 engages an edge of the internal ribs 451 when the elasticity of the plastic material straightens the tab 441. The button 405 butts up against one of the internal ribs 451 to keep the button 405 properly positioned on the mouse 401, and the engagement of the hook 445 with the internal ribs 451 prevents the button 405 from being removed from the mouse 401 after assembly. The mouse 401 illustrated in Figure 6 has the same external appearance as the prior embodiments and utilizes the disclosed switch configuration. A top view of the mouse 401 would be the same as Figure 2, and a cutaway top view would be the same as Figure 3.

Although an elastic plastic hinge is part of the preferred embodiment, any other hinge or deflection device can be used with the inventive mouse. If a multiple piece hinge is used, it may not act as a reset spring, and only the internal spring (not shown) of the switch will rotate button into its normal position. In alternative embodiments, an

internal spring may be incorporated into the mouse body that resets the buttons when an actuation force is not applied to the buttons.

As discussed, the inventive mouse is substantially hemispherical in shape and small in size that allows children and users with small hands to cup and more precisely position the mouse. In the preferred embodiment, the overall inventive dimensions of the mouse should be proportional to the average-sized child's hand. Table 1 lists average dimensions of various hand parameters of children 4, 6 and 8 years of age. Table 1 also lists the average dimensions of an adult hand for comparison. Note that the dimensions of the adult male hand are approximately 68 %, 48 % and 35 % greater than the average 4, 6 and 8 year old children's hands, respectively. The hand dimensions of Table 1 are in inches. Figure 8 illustrates where the listed dimensions are measured on a hand.

	4 year old child	6 year old child	8 year old child	Adult male
Hand length	4.6	5.1	5.6	7.5
Hand Breadth	2.1	2.3	2.5	3.5
Index finger length	2.6	2.9	3.2	4.5
Dorsum length	1.8	2.2	2.4	3.0
Thumb length	1.6	1.8	2.0	2.7

Table 1

In order to accommodate the smaller dimensions of children's hands, the size of the inventive mouse must be proportionally smaller than an adult mouse. The length of the inventive mouse is approximately 3.5 inches, and the width is approximately 2.3 inches. In contrast, a typical adult mouse is approximately 4.8 inches in length and approximately 2.7 inches in width. The inventive mouse is easier for a child to precisely position because it is a better fit with the child's hand.

Figure 9 illustrates a top view of a single-button embodiment of the inventive mouse 601. The mouse 601 has a body 603 and a button 605. The button 605 has a

continuous arc shape that curves from a substantially horizontal surface at the top of the button 605 to a substantially vertical surface at the front of the button 605. The button 605 is mounted to a single hinge (not shown) that is attached to the top center section of the mouse body 603. The button 605 can be actuated by applying a downward force on the upper vertical surface of the button 605 or a compressive force to the front vertical surface of the button 605. When this type of force is applied, the button 605 rotates forward about the hinge, and one or two electrical switches within the body are actuated.

Alternatively, a torsional force can be applied by applying an inward force to any side of the button 605. This torsional force causes the hinge to twist and an internal rib to actuate at least one of the internal electrical switches. Because the hinge is located above the switch, the side force causes the button to twist. If the right side of the button is pressed, the right side of the button will rotate down, and an internal rib will actuate the right internal button. If the left side of the button is pressed, the left side of the button will rotate down, and an internal rib will actuate the left internal button. The single-button mouse embodiment requires a signal-button driver and operates in a manner similar to the two-button mouse that uses the single-button mouse driver described above.

While the present invention has been described in terms of a preferred embodiment above, those skilled in the art will readily appreciate that numerous modifications, substitutions and additions may be made to the disclosed embodiment without departing from the spirit and scope of the present invention. For example, although the mouse has been described above for use with a computer, those skilled in the art will readily appreciate that the inventive computer mouse may be utilized in any similar electronic device and that the present invention is in no way limited to the

ABSTRACT

An improved mouse computer input device is provided that can easily be controlled by both the small hands of children and the larger hands of adults. The mouse is substantially hemispherical in shape, and the buttons of the mouse curve in a continuous arc from substantially horizontal at the top area to substantially vertical at the front area. The buttons of the mouse are activated by either applying an inward force to the front vertical surfaces of the buttons, pressing downward on the top horizontal surfaces of the buttons or applying inward forces to the sides of the buttons.

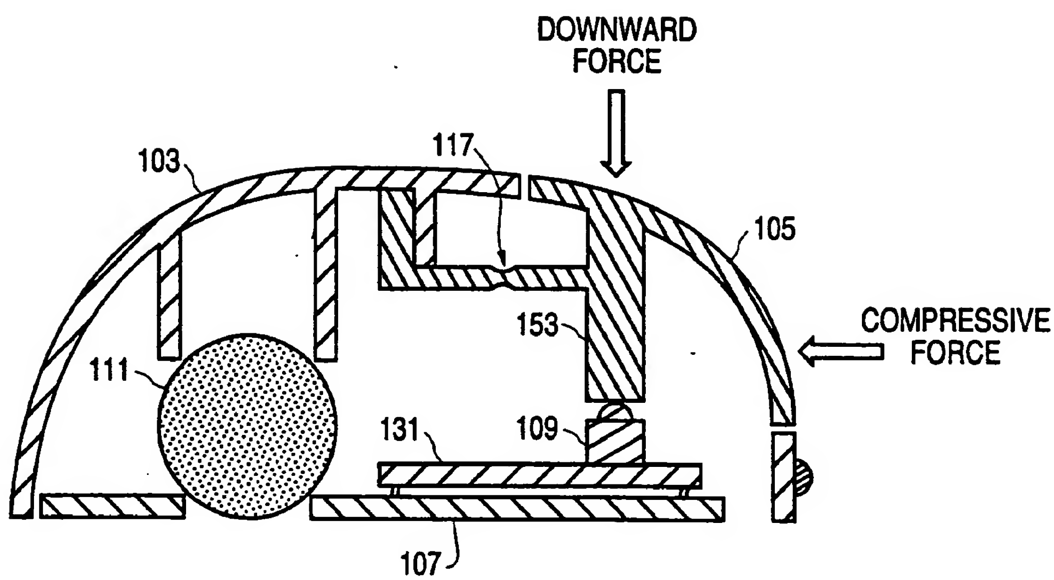
DOWNWARD FORCE
103
117
105
COMPRESSIVE FORCE
153
111
131
109
107

FIG. 1

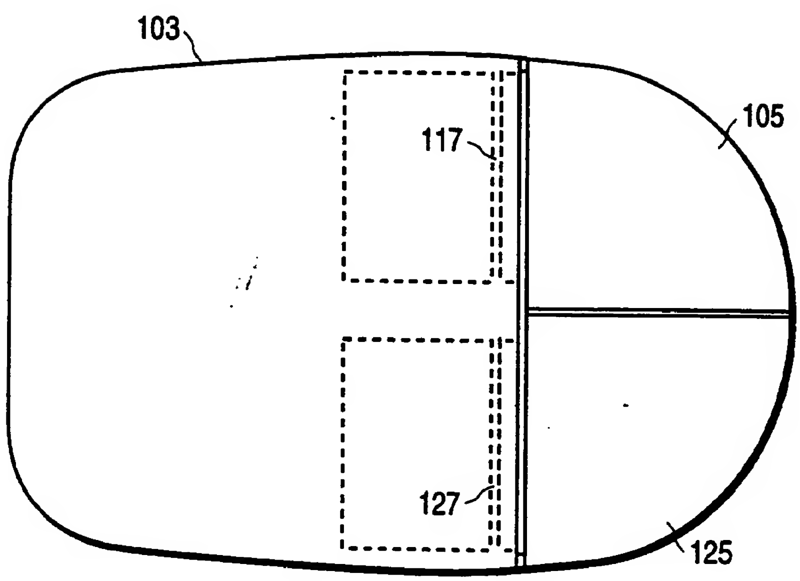

FIG.2

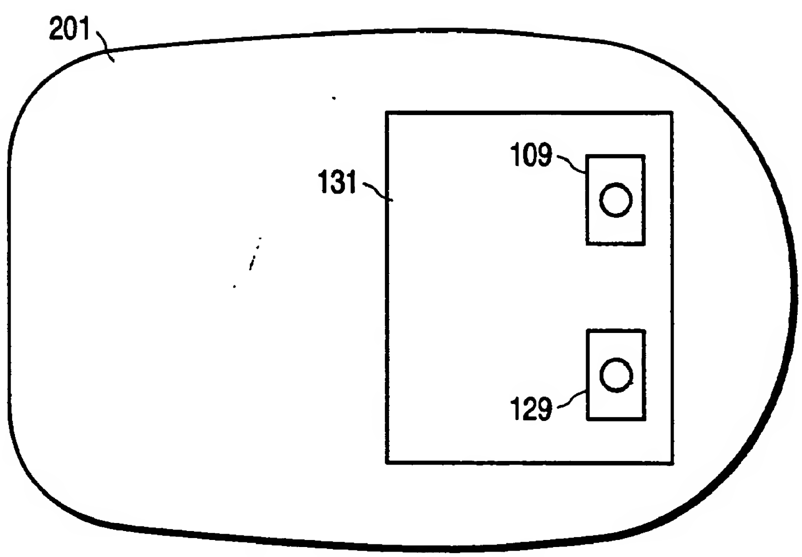

FIG. 3

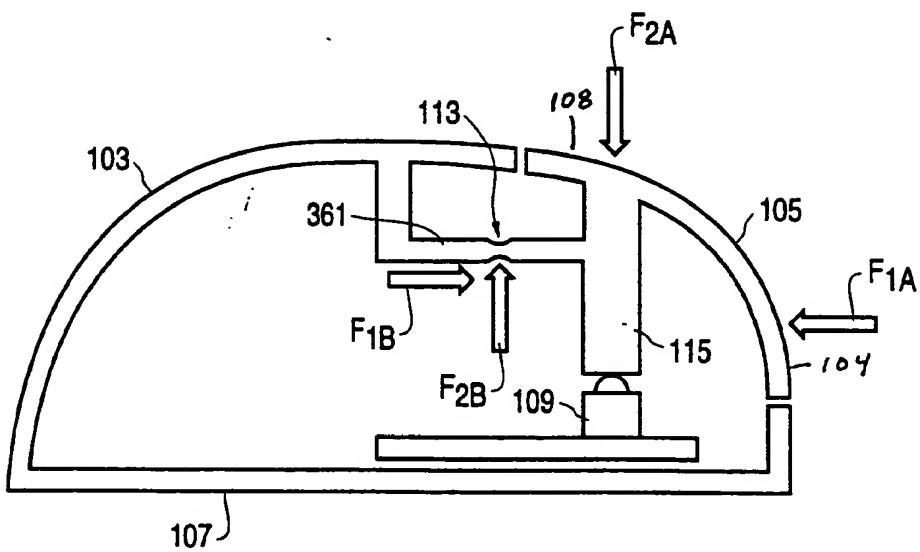

FIG. 4

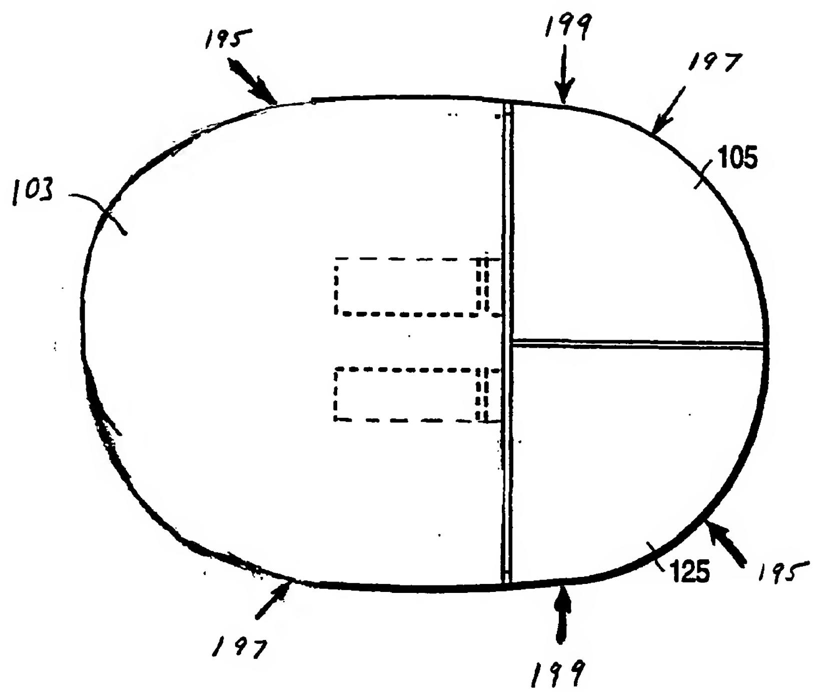

FIG. 5

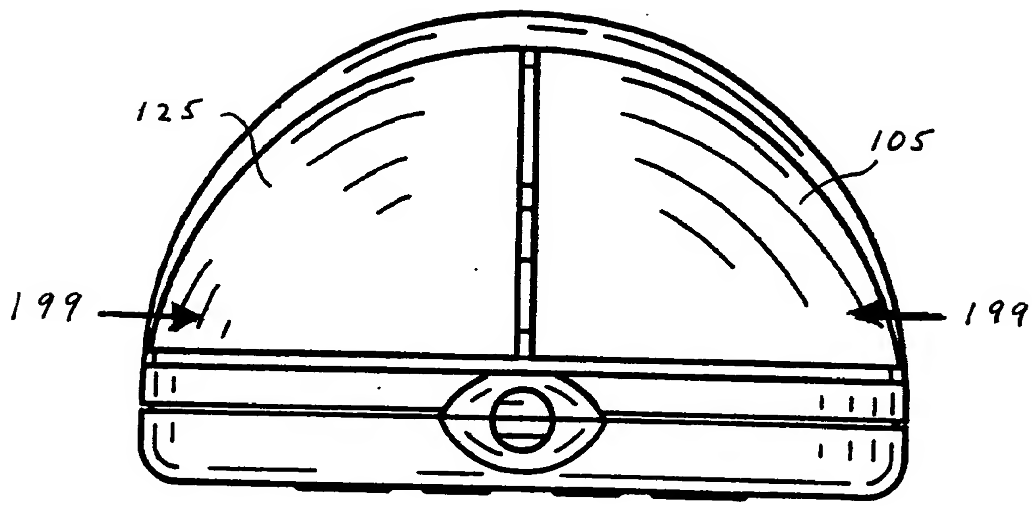

FIG. 6

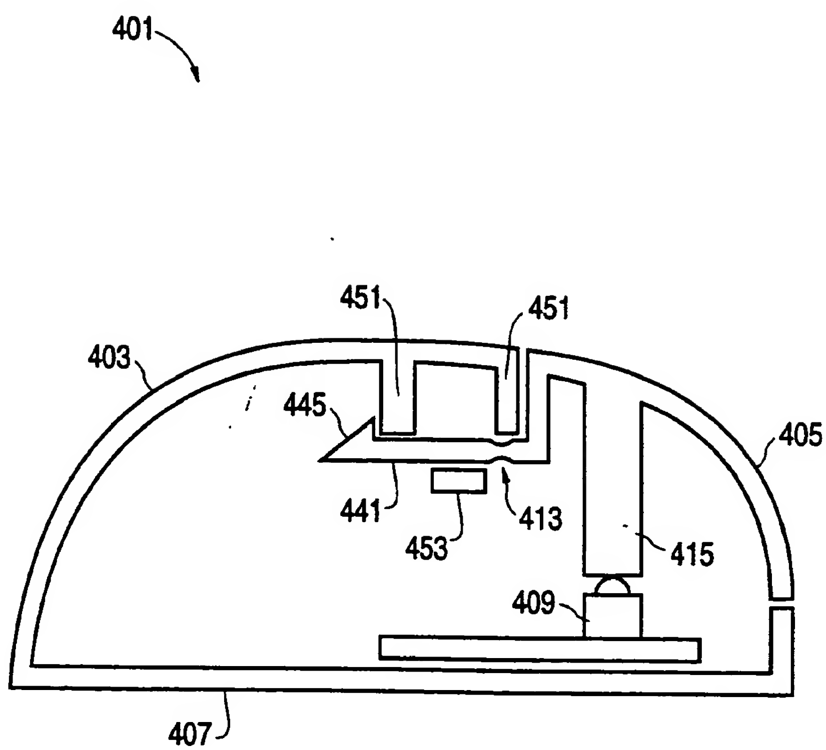

FIG. 7

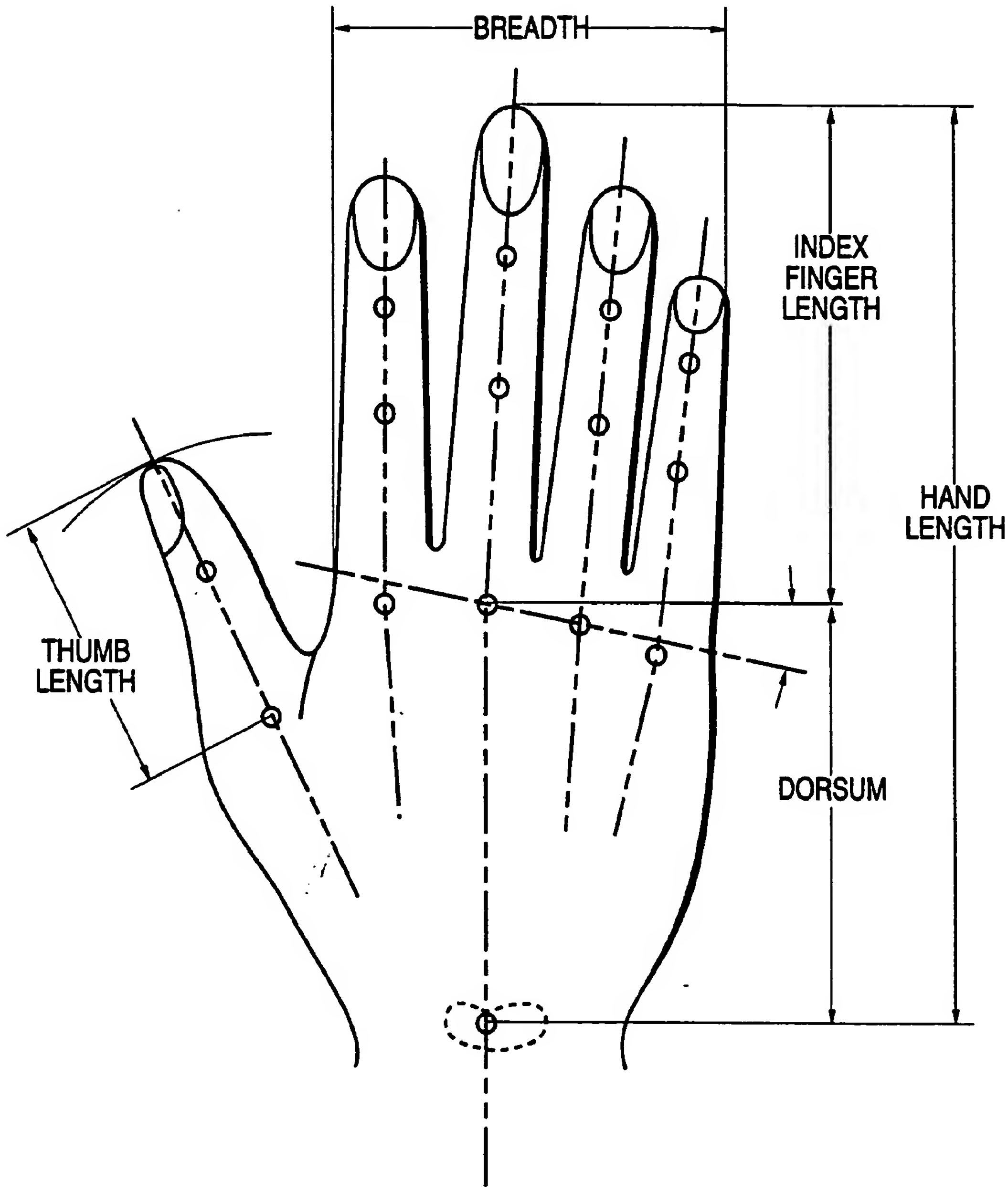
BREADTH
INDEX
FINGER
LENGTH
HAND
LENGTH
THUMB
LENGTH
DORSUM

FIG. 8

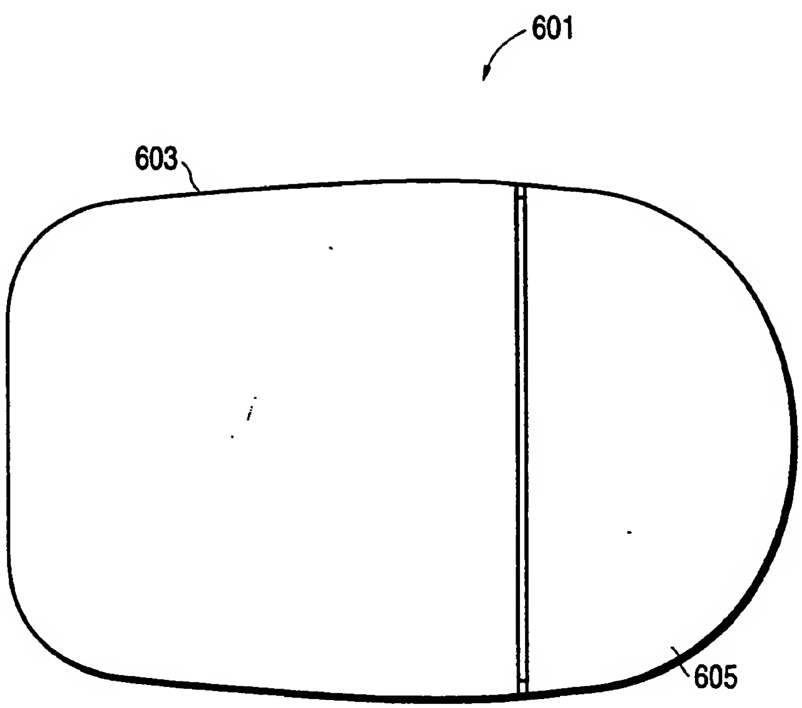

FIG. 9